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Frequency of Incidental Findings and Outcome Measures in Patients Admitted to an Urban Level I Trauma Center

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Methods: A retrospective cohort analysis of all head, spine, face, chest, abdomen, and pelvic CT scan reports in adult patients admitted to a Level I urban Trauma Center over a three month period was undertaken to determine the frequency of incidental findings and subsequent follow-up either in the acute care or outpatient setting.

Results: A total of 500 consecutive patients received 3,460 CT scans with an average of 6.9 scans per person per admission. The population was predominantly male (71 %) with a mean age of 45 years. Incidentalomas were found in 65% of patients (325/500) yielding 760 individual findings. The most common incidentaloma involved degenerative spine disease in 50% followed by liver, head and neck, kidney, and other diagnoses. Further follow-up was recommended in 80 radiology reports with 27 of those indicating future follow-up. Twenty-six diagnostic studies and ten specialist consultations subsequently occurred.

Discussion: Incidentalomas are becoming increasingly common with the utilization of sensitive scanning by computed tomography. Our findings are consistent with those of other studies that have determined the frequency of the incidentaloma. We also encountered similar challenges regarding incomplete follow-up of those patients needing systematic follow-up. Several issues impending adequate follow-up probable in our population include, lack of insurance, transportation, or other social situations encountered in the trauma population as well as inconsistencies in staff communication, recommendations, and adequate description of findings.

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Keywords
Incidentaloma, incidental finding, trauma, CT scan

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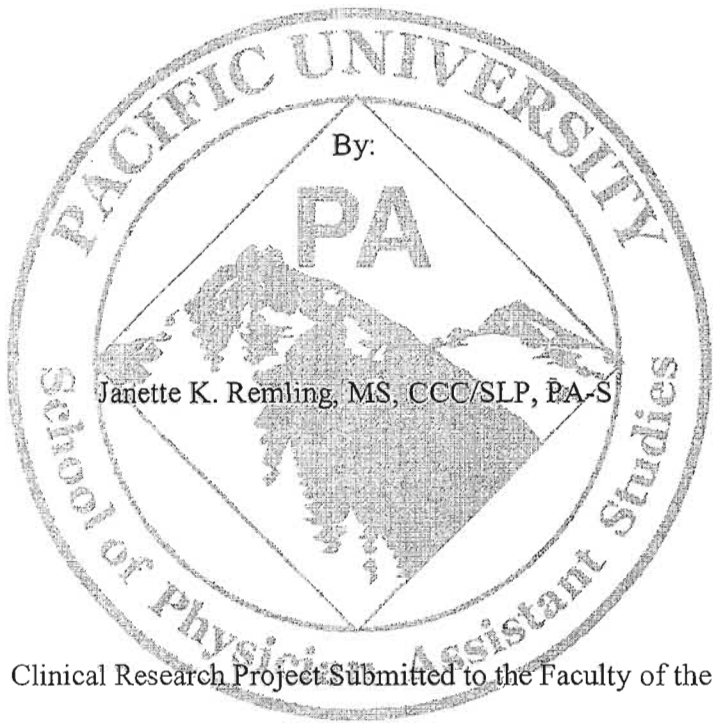

By:

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BIOGRAPHY

Janette is a "military brat" having been born in Mississippi with moves to Illinois and California before spending most of her childhood in San Antonio, Texas. Janette's inspiration to pursue a career in healthcare began with her parents. Her mother is a pediatric occupational therapist and her father is a retired Air Force cardiopulmonary technician. Her brother and sister-in-law also share Janette's desire to further their medical careers, both currently attending undergraduate and graduate programs in Nursing. Needless to say, Janette's parents will let out a sigh of relief as she graduates from the Pacific University Physician Assistant program in August 2006.

Janette received her Master's of Science degree in Communication Disorders at Texas State University in 1996 and has worked as a hospital-based speech-language pathologist since then. Most of her professional career has been devoted to working with patients following traumatic brain injury, cerebrovascular accident, and head and neck cancer. Janette moved to Portland in 2001 after living in Tucson, AZ for several years to escape the hot, humid Southwest summers and participate in the outdoor activities she loves. She began working at Legacy Emanuel Hospital and after much contemplation decided to return to school at Pacific University to further her medical career and provide her with new opportunities.

Janette's passions include spending time with her family and friends, snow skiing, hiking, mountain biking, traveling, and watching the San Antonio Spurs and Texas Longhorns. She hopes to remain in Portland and work in an Otolaryngology or Neurosurgery practice upon graduation.

Abstract

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Background

The use of computed tomography (CT) has dramatically increased since its inception in 1972. Its effectiveness and accuracy in the evaluation of patients admitted through the trauma system has only escalated its employment. The clinical importance of CT scanning for trauma patients is demonstrated in California, where a state law stipulates that if the CT equipment is inoperable a hospital must divert its trauma patients to adjacent facilities only to receive patients "in extremis".[1]

In addition to evaluating trauma, CT scans uncover incidental findings of potential clinical significance unexpectedly discovered and unrelated to the patient's reason for admission. The phenomena of improved imaging capabilities leading to incidentaloma can cause patient distress and anxiety about serious illness, generate additional diagnostic tests, or other therapeutic interventions. A significant dilemma surrounds what exactly to do with the patient diagnosed with an incidentaloma. Further work-up in the case of a five centimeter incidental adrenal mass is considerably clearer than one that is two cm. Although the literature has reviewed the frequency at which these incidental findings are discovered, very few studies have neither determined actual economic impact of incidentalomas nor any particular plans to address the problem.[2] One study, which discovered incidentalomas in eight percent estimated that the additional cost per incidental finding per patient was approximately $400.[3]

Additionally, there is concern regarding inadequate follow-up of these patients related to lack of clinical correlation, other more pressing diagnoses, communication errors, or discharge of the patient prior to final CT report analysis. Messersmith, et al examined 321 abdominal CT reports performed in patients seen in the emergency department with

symptoms suggestive of renal colic.[4] They discovered incidental findings in 47% of the patients (145/307) with 51% of those considered either "moderate" or "severe" with regard to level of concern. Of those incidental findings, only 21% of them had any notation in the ED record regarding the finding. Over a two-year period less than 15% of the more "moderate" or "severe" cases had evidence of additional work-up. Another study completed at Akron General Medical Center, which evaluated the chest, abdomen, and c-spine films on 2,342 trauma patients discovered that 25%of their patients had incidental findings and of those ¼ required follow-up diagnostics or treatment .[5] Fifty-seven percent of those patients actually received adequate follow-up care. The authors discovered that there was not a correlation between early discharge nor problems with communication that lead to the lack of follow-up. They suggested that better documentation and education of the attending trauma surgeons and residents as well as implementation of a protocol to deal with these findings should be considered.

Certainly a number of incidental findings are actually benign and may not necessitate additional diagnostic work-up. A study completed by Rizzo, et al. discovered that of the 1609 trauma patients who underwent a total of 2047 scans, only 29% of the findings were beneficial to the clinical care of the patient.[6] This study brings to light several issues with the extensive utilization of CT scans in trauma patients, including morbidity and cost. The judicious use of scanning in the trauma patient by the attending physician should be implemented for not only cost containment issues but also time utilization.

This paper set out to determine the prevalence of incidental findings in trauma patients admitted through the trauma system and further to determine if and what type of follow-

up was provided. A review of the literature was undertaken to describe the most commonly occurring incidental findings during radiographic or sonographic study.

Brain

According to Weber and Knopf, clinically significant neuropathologies occur in 0.5% to 2% of the population, although variability exists among sources.[7] Commonly discovered incidental intracranial abnormalities are pituitary adenoma (10% of diagnostic procedures),[8,9] meningioma (33% of all incidental intracranial tumors),[10] osteoma, basal ganglian calcification (0.3% to 0.6%), intracranial arachnoid cyst (0.4% to 1%), and cisterna magna variations (enlargement of cisterna magna reported in 0.3% to 0.4%). A study performed on 3000 patients admitted with head trauma revealed thirty incidental abnormalities, including eight cases of brain tumor.[11]

Solitary Pulmonary Nodule (SPN)

A solitary pulmonary nodule is defined as an intraparenchymal lung lesion that is < 3cm in diameter and not associated with atelectasis or adenopathy.[12] Lung lesions > 3cm in size are defined as lung masses. Studies have shown that of 500 chest radiographs, one will demonstrate a pulmonary nodule. Of those, ninety percent will be considered incidental findings discovered unexpectedly.[12]

Once a pulmonary nodule is discovered, a systematic approach to further evaluation and management is recommended in the literature.[13] The patient's pre-test malignancy probability (i.e., clinical risk factors), surgical risk, and findings on CT should guide the clinician in further diagnostic measures. Multiple studies have found that the size of the nodule offers good indication of malignancy. A large majority of nodules > 2 cm in size are malignant, compared to a rate of 50% in those less than 2 cm. Accordingly, it is

suggested in the literature that a patient with an SPN without a tissue diagnosis (i.e., fine need aspiration) and who presents with low probability of malignancy should be followed closely for a minimum of two years. Testing should include CXR and CT scanning at 3, 6, 12, and 24 months.[13]

Thyroid

Approximately 4% to 10% of the population is found to have solitary thyroid nodules on autopsy.[14-16] Close to 90% of thyroid nodules are benign, but because a small percentage of these may be malignant, incidentally discovered thyroid nodules warrant further investigation. A systemic approach leading to utilization of medical resources for those patients with higher risk of malignancy should be undertaken. Since CT is ineffective in detecting malignancy, a thorough history and physical including determination of risk factors is recommended.[15] Typically, the thyroid nodule is followed up with ultrasonography and laboratory data to include thyroid stimulating hormone (TSH).[14, 16, 17]

Adrenal

Most research regarding incidentalomas has concentrated primarily on the adrenal mass. According to autopsy data, the prevalence of adrenal mass is at least three percent in persons over 50.[18] Estimation of incidental adrenal finding during clinical evaluation by ultrasound is 0.42 percent among patients evaluated for nonendocrinologic complaints and 4.3 percent among patients diagnosed with cancer. In those imaged with CT, incidental adrenal masses are found in 0.35-1.9%.[18, 19] Most adrenal masses are benign, non-hypersecretory adenomas and one in 10,000 is malignant.[18-20] The low prevalence of adrenal cortical carcinoma and low incidence of progression to a hyperfunctional state proves a dilemma in determining the appropriateness of long-term management although

several diagnostic models have been suggested.[18,20-22] The NIH Consensus Development Program produced a state-of-the-science statement in 2002, all patients with an incidentaloma should have a 1-mg dexamethasone suppression test and a measure of plasma-free metanephrines. Follow-up images in three to six months can confirm the stability of the growth.[18]

Liver

A study performed with 1892 patients who received contrast-enhanced spiral hepatic CT revealed 108 hepatic lesions.[23] Most lesions were benign-cysts (80) or hemangiomas (18), which would indicate that further work-up is not necessary in the majority of patients.[23] The most common benign hepatic lesions are cysts, hemangiomas, focal nodular hyperplasia, and hepatocellular adenomas.[24] For these findings, typically no additional work-up is required unless there are complications, such as bleeding into a cyst or hemorrhage of a hemangioma. Little, et al. propose conservative management in at least half patients with the remaining needing angiography or fine-needle aspiration.[25]

Breast

Frequency of incidental breast lesions is difficult to locate in the literature, but several MRI studies have attempted to document the prevalence.[26-28] In one study, completed by Teifke, et al. of 1273 MRIs completed, 16% of those patients were found to have an incidental breast mass. Forty-eight percent of the enhancing lesions examined histologically and 20% of all enhancing breast lesions were malignant.[26]

Although in those patients with probably benign or benign-appearing lesions did not present with malignancy, the investigators did develop a management algorithm of the enhancing incidental lesions detected on MRI based on probability of malignancy. The

authors recommended biopsy of suspicious lesions and careful follow up of probable benign lesions. And in those indeterminate enhancing lesions, histological examination with use of minimally invasive techniques or MRI at six months, if the lesions were small.[26]

Renal

It is estimated that greater than 50% of all renal masses are detected incidentally.[29] Identification of incidental detection of renal cell carcinoma has risen steadily over the last thirty years in part because of because of advancements in imaging procedures.[29] Vasudevan et al. found that in incidental, asymptomatic renal masses <5cm 33% of the cases that were thought to be malignant based on radiologic features ultimately proved to be benign.[30] The authors recommended routine use of core biopsies in those masses where malignancy was indistinguishable from a benign process. Another study performed by Wehle et al. revealed of 29 consecutive patients diagnosed with incidental, small contrast-enhancing renal masses, three of four patients who underwent radical nephrectomy were diagnosed with renal cell carcinoma.[31] None of the patients had developed malignancy with careful monitoring with CT scan after an average follow-up of 32 months.

Methods and Materials

The retrospective cohort analysis included the CT scan results of 500 consecutive patients admitted through the trauma system at Legacy Emanuel Hospital, a Level I trauma center, from 9/20/05 to 12/31/05. Patients were identified utilizing the Trauma Registry and all data was kept separately from identifying information in compliance with HIPAA (Health Insurance Portability and Accountability Act) guidelines. Each patient's admitting history and physical, discharge summary, and diagnostic studies were reviewed in the electronic record to determine patient age, gender, mechanism of injury, co-morbidities, and number and type of CT scans received. All head, spine, face, chest, abdominal, and pelvic scan reports performed during the patient's admission were reviewed for this study. Three patients whose injuries contributed to their mortality were not included nor were patients under the age of 21. CT scans were completed on a Siemens Sensation 16-Slice CT scanner and the scans reviewed by two board-certified radiologists.

CT scans with an incidental finding, considered to be diagnoses unrelated to the patient's reason for admission and unknown to the patient prior to his/her admission, were then subdivided into solid versus soft tissue and then according to body system (Table 1). The findings then prompted additional review of the discharge summary to determine follow-up information. Follow-up was deemed complete if the radiology report recommended additional work-up and subsequent scan or specialist consultation occurred as a result either in the acute care or outpatient setting.

Results

The patients ranged in age from 21 to 93 with a mean age of 45 years (Figure 1). Seventy-one percent of the patients were male (356/500). A total of 3,460 CT scan reports were reviewed, which were further divided into 1,121 spine CT's; 682 head CT's; 155 facial scans; 461 chest CT's; 503 abdominal CT's, and 538 pelvic scans (Figure 2). Patients received between one and 35 CT scans with an average of 6.9 scans per person per admission. Incidentalomas were found in 65% of patients (325/500) yielding 760 individual findings (Figure 3). The average age of patients with incidentally discovered abnormalities was 52.

Figure 4 reveals the total numbers of incidental findings per system. Solid tumors were found in 72 cases and soft tissue abnormalities were seen in 109. Skeletal incidentalomas accounted for the greatest number of incidentalomas at 384 (50%), followed by liver (69), head and neck (165), renal (60), other diagnoses (54), pulmonary (44), gynecologic (21), cardiovascular (16), brain (14), adrenal (13), thyroid (10), breast, small intestine (3), and finally colorectal (1).

Follow-up was recommended in the radiology reports of 80 patients, which included recommendations for future diagnostic studies in 27 patients. A total of 18 subsequent CT scans or MRIs, eight ultrasound studies, and ten specialist consultations occurred as a result (Figure 5). The discharge summaries of ten patients revealed recommendations for follow-up, but in twenty-one no notations were made.

Skeletal

Three hundred eight of the 384 skeletal findings revealed degenerative spine disease, including degenerative disc disease (DDD) and osteophyte formation (Table 2). A total of 119 patients presented with DDD and 189 with degenerative changes including evidence of spurring or osteophyte formation. Another 41 demonstrated other degenerative changes such as spondylolisthesis, spinal stenosis, or osteopenia. The average age of patients with DDD was 59 and in those with degenerative changes the average age was 53. Of the ten patients with documented solid lesions, four were recommended for follow-up (or future work-up) with one patient diagnosed with an 8 mm lesion of the right iliac crest currently being followed by his PCP according to the Trauma Clinic notes.

Liver

Hepatic cysts and hemangiomas accounted for half the hepatic findings (Table 3). Fatty liver was found in 23 patients and hepatic lesions were seen in eleven. Of those found to have lesions, seven were recommended for follow-up resulting in five patients receiving additional diagnostic studies. One patient was initially found to have a liver mass and a 3-phase liver CT was recommended (Figure 6). Subsequent chest/abdomen CT revealed a 2.5 cm hepatic mass, a 4.4 cm lesion at the retrosigmoid junction, and a questionable nodule at the right lateral wall of the rectum. These findings then prompted a colonoscopy with biopsy. Pathology revealed adenocarcinoma of the proximal rectum and tubovillous adenoma of the colon and rectum for which the patient received therapeutic management post resolution of the trauma issues. The patient also is receiving outpatient management for the hepatic lesion by his primary care provider.

Head and Neck

Sinusitis accounted for 83% of all the head and neck incidental findings (Table 4). Three patients each were found to have tracheal lymph nodes or nasal polyps. Three findings prompted recommendations for follow-up, including left mandibular lesion, mass at the right nare, and an orbital lesion. The OMFS team consulted on the patient diagnosed with the right nare mass and recommended further management when patient discharged home.

Renal

Fifty patients were diagnosed with renal cysts making up 83% of the kidney findings (Table 5). Recommendations for future follow-up studies (typically ultrasound and renal-dedicated scanning) occurred in three patients, prompting additional work-up in two of them. Two renal lesions were discovered, one precipitating radiology recommendation for follow-up. No documented follow-up was located. Other renal findings were atrophy and calcification.

Other Diagnoses

Primary findings in this category included gallstones (13), hiatal hernia (9) and seven patients were found to have inguinal or umbilical hernia, lymphadenopathy not otherwise specified, or enlarged prostate (Table 6). Follow-up was recommended in three patients, including one with gastric wall thickening, one with hiatal hernia, and lastly a patient with mediastinal mass. All three of these patients received follow-up diagnostic intervention. One patient underwent surgical repair, Nissen fundoplication, and gastrostomy tube for an incidentally discovered large paraesophageal hernia with delayed

surgical management of a Zenker's diverticulum (Figure 7). Additionally, one other patient received medical management for a diagnosis of enlarged prostate.

Pulmonary

Pulmonary nodules accounted for the most pulmonary findings at 24, and also prompted the majority of radiology recommendations for future follow-up in 13 (Table 7). Three patients received further work-up and no other data was available or could be found that suggested the others had additional work-up. Emphysema was seen in six patients, lymph nodes in four, and granulomas and thickening were seen in two each. Pulmonary lesions were seen in three patients with one patient receiving additional work-up.

Gynecologic

Fourteen patients were diagnosed with adnexal cysts, four with uterine lesions, and one each with enlarged uterus, fibroid, and ovarian tumor (Table 8). Four recommendations for follow-up with one for future diagnostics resulted in gynecologic consultation for the tumor and follow-up ultrasound for a three cm adnexal cyst.

Cardiovascular

The most common cardiovascular, non-cardiac incidental findings were ectasia of the aorta in five patients and atherosclerosis in four (Table 9). Two patients were diagnosed with abdominal aortic aneurysm (AAA) at two and three centimeters. Neither was recommended for follow-up. Calcified mitral annulus with left atrial dilation was seen in one patient. Two vascular consultations were obtained in-house for aortic atherosclerosis in one patient and a 2 x 2.5 cm aneurysm of the proximal right common iliac artery in another.

Brain

Intracranial findings made up fourteen findings with multiple diagnoses noted (Table 10). Three patients diagnosed with hydrocephalus and one with chronic bifrontal subdural hygroma prompted neurosurgical consultation. One patient, a 47 year-old male subsequently underwent third ventriculostomy (Figure 8). One patient received a subsequent MRI resulting in diagnosis of colloid cyst and recommendation for future follow-up in three-to-six months.

Adrenal

Adrenal abnormalities were discovered in 13 patients (Table 11). Density and nodularity were discovered in ten patients and enlargement or fullness was noted in three. Radiology reports indicated recommendations for follow-up in 11 of the 13 with resultant additional testing in six. Two patients were discharged to follow-up with a facility as denoted by their insurance company and two patients' abnormalities were considered benign following further diagnostic studies. Three other patients were instructed to follow-up with repeat scanning in three-to-six months (Figure 9).

Thyroid

Thyroid lesions were seen in three patients; hypodensities, enlargement, and calcifications in two each; and cyst in one (Table 12). Follow-up was recommended in five patients, resulting in further management in two patients. One patient was found to have a thyroid cyst, likely colloid. The thyroid findings were discussed with the patient at Trauma Clinic after discharge with no further follow-up warranted.

Breast

Breast abnormalities occurred in five patients, with masses seen in all five (Table 13). Three densities were between 1-2 cm in size, whereas the other two lesions' sizes were not indicated. Recommendations of physical examination combined with mammography were recommended in four cases. No follow-up was performed in any patient, and there was no indication of the findings in the discharge summary, including recommendations for future follow-up.

Colorectal

Two patients were diagnosed with colorectal abnormalities (Table 14). One each of the following was documented: colon polyp and soft tissue density of the cecum. Further work-up was recommended in three cases. A colonoscopy was performed in-house for colon polyp and barium enema was performed for the density in the cecum in-house.

Small Intestine

Intussesception, small bowel lipoma and thickening were the three abnormalities documented on CT (Table 15). All recommendations for follow-up were adequately addressed. A CT with IV/oral contrast performed resulted in resolution of the findings of intussesception. Outpatient CT scan with subsequent exploratory laparoscopy and colonoscopy were completed for the small bowel thickening.

Discussion

Sixty-five percent of the patients included in this study demonstrated incidental findings, although this number is reflective of the significant degenerative spine changes seen in the population (352 patients). Even when discounting those patients with degenerative spine disorders, 52% or 408 patients were diagnosed with incidental findings. Even though the average age of patients found to have degenerative spine or disc disease is typical of the general population, the study revealed a moderate number of patients in their 20's and 30's. Approximately 20% of the patients with degenerative changes were under forty years-old. A review of the literature has indicated that disc degeneration, at least at the lumbar spine, has been identified as early as childhood and that great variability in degenerative findings exist within age groups.[32] Typically, though, disc degeneration increases with increased age with Miller et al reporting 16% of individuals at the age of 20 to 98% of patient at age 70 being diagnosed on autopsy specimens.[33] The specific findings for each sub-system appeared consistent with what is indicated in the literature. Over half the hepatic and renal findings were cysts and pulmonary nodules were also prevalent in this study.[12, 23] The data revealed recommendations for follow-up in 80 of the radiology reports with an actual follow-up rate of 46% (37/80), which, when compared with the literature reveals a better than average percentage of follow up.[4, 34] Of the four patients who were found to have intracranial incidentalomas, all were followed up adequately with subsequent scanning and neurosurgical intervention as deemed necessary. Consistent with the literature, the majority of the patients with solitary pulmonary nodules were recommended for future CT scanning in 3-6 months or for comparison with prior scans.[13, 14] Unfortunately, the actual numbers of patient follow-up

may not have been reflective in the results related primarily to the fact that if the outpatient CT scan or follow-up was not done through the hospital system, there was no evidence of further management. If time constraints were not an issue, the authors should have contacted the patients to determine if indeed they received additional care of their findings upon acute care discharge.

In those patients with thyroid abnormalities, follow-up was recommended in five of the nine patients resulting in further inpatient evaluation in two patients. No indication of follow-up was indicated in six of the nine patients. Similarly, in the five patients found to have breast mass, follow-up was recommended in four and no follow-up was performed either while in-house nor included in the discharge recommendations, which is inconsistent with recommendations found in the literature.[26]

There were several limitations to this study as analysis and interpretation proceeded primarily related to data collection. Only the radiology reports were utilized in extracting data, which lead to several problems. Multiple radiologists read the scans, likely contributing to variability in recommendations as well as description of findings. There were instances where a particular finding's characteristics were more completely detailed than another. The lack of specific characterization regarding findings impacted our determination as to whether a particular lesion or mass was significant enough to warrant additional studies.

Also, it appeared that some of the more commonly observed diagnoses, such as gallbladder disease and renal calculi did not account for a large percentage of the findings. It is unclear if that is a direct reflection of the age distribution or related to radiologic interpretation. The authors could have visualized and interpreted the CT scans

themselves in addition to the radiologists, which may have led to additional, more detailed information, consistent interpretation, and recommendations, but were limited by time constraints.

Another limitation encountered included the determination of whether a finding was actually "incidental" or not. This author relied on the dictated history and physical in the electronic record to determine if the patient's finding(s) were indeed known to them. There is a real possibility that variations in the history may have contributed to an overestimation of incidentalomas depending upon the patient's and family's recollection and thoroughness as well as the admitting attending physician's recall and inclusion of each diagnosis in the H/P. Rotation of resident and attending physicians also may have impacted the management decisions of each patient's incidentaloma.

Lastly, many patients were lost to follow-up because they did not return to trauma clinic after discharge, which is requested of patients two to three weeks post acute care discharge. Three of five notes from Trauma Clinic visits included discussion of the patient's findings. The numbers of patients not seen in trauma clinic may have been reflective in insurance preferences, socio-economic limitations, or geography. In these cases, it was impossible to determine whether or not their findings were properly evaluated and/or managed in the outpatient setting.

Conclusion

A protocol for managing patients with incidental findings, once they occur, should be implemented. Considering the extensive utilization and sensitivity of current radiologic procedures, the likelihood of discovering incidental findings will continue to increase. Balance is needed to ensure appropriate and safe care for each patient as deemed necessary and ethical while maintaining cost effectiveness. A facility must weight the economic costs and morbidity of additional interventions against potential benefits of early detection of potentially serious asymptomatic conditions.

Utilizing expensive resources, particularly in light of increasing health care costs is a real concern. The aggregate charges, or sum of all charges for all hospital stays in the U.S. discounting federal institutions for 2002, was $650 billion.[35] This amount is an increase of 32 percent from 1997, when the charges were $492 billion when adjusted for inflation. Medicare and Medicaid are billed approximately 56% of all hospitalizations and private insurances are billed for 36% of hospitalizations. Uninsured hospitalizations account for approximately five percent, which is comparable to the figure in 1997. The aggregate total billed adjusted for inflation to Medicare is $283 billion, an increase of 29 percent; Medicaid is $119 billion, an increase of 47 percent; and the uninsured was billed $25 billion, an increase of 39 percent when compared to 1997 statistics. Keeping these rising costs in mind, physicians should apply rigorous evidence-based practice regarding the work-up of these incidentalomas.

The discovery of incidental findings in patients should generate several questions: 1) Does the incidental finding place the patient at risk for an adverse outcome? 2) Can individuals with treatable syndromes be accurately diagnosed? 3) Is the treatment of

those syndromes more effective in presymptomatic patients? and 4) Do the beneficial effects of pre-symptomatic detection and treatment of these patients justify the additional costs?[4, 16] This study demonstrates the need for practice guidelines for the management of patients with incidental findings.

Table 1 Systems utilized for charting of incidental findings.

1. Solid tumor	8. Breast	15. Other
2. Soft tissue	9. Kidney	
3. Head and Neck	10. Adrenal	
4. Brain	11. Liver	
5. Thyroid	12. Small intestine	
6. Heart	13. Colon/rectum	
7. Lung	14. Gynecologic	

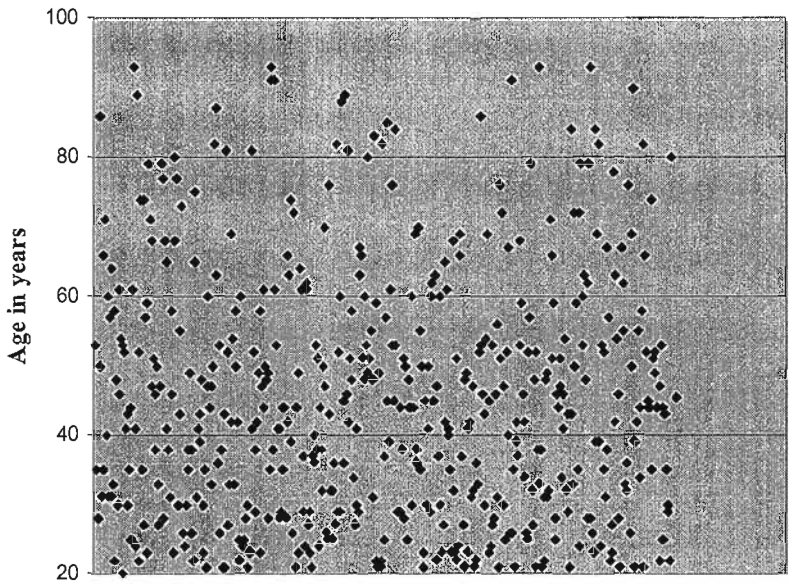

Fig. 1. Age distribution of patients. Average age of 45 years-old.

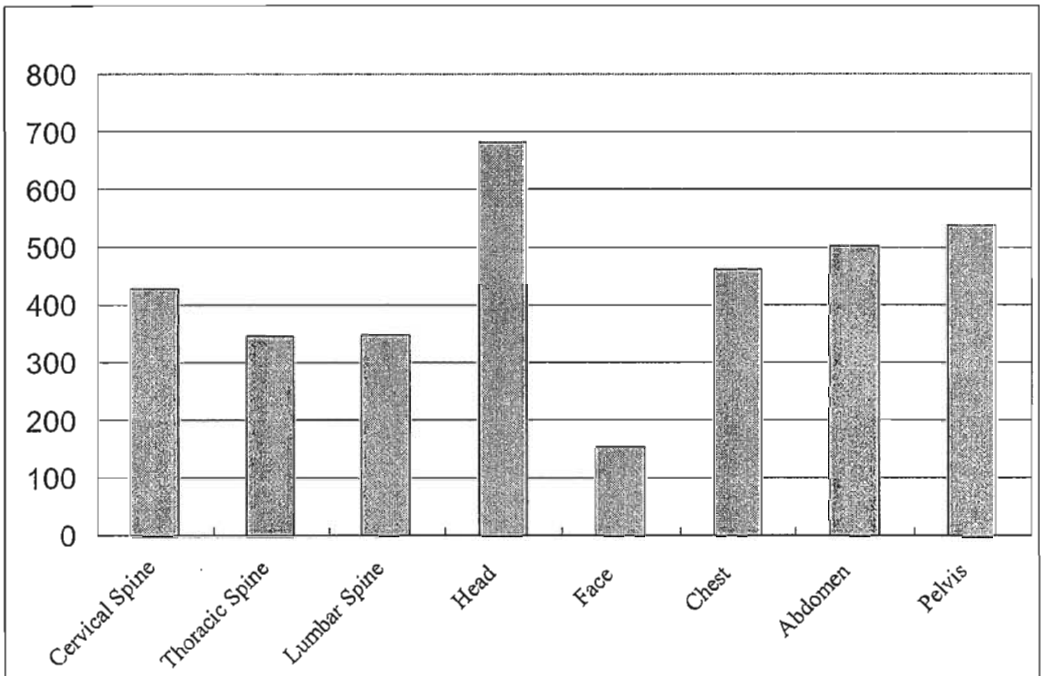

Fig. 2. Total number of CT scans by type of scan.

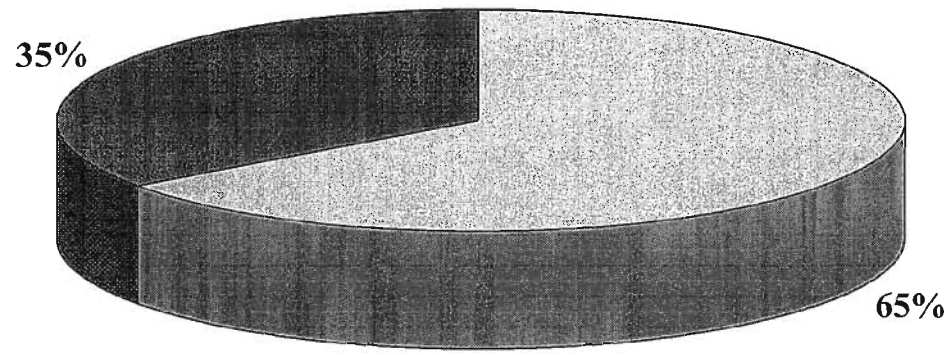

Fig. 3. Patients with incidental findings (325/500).

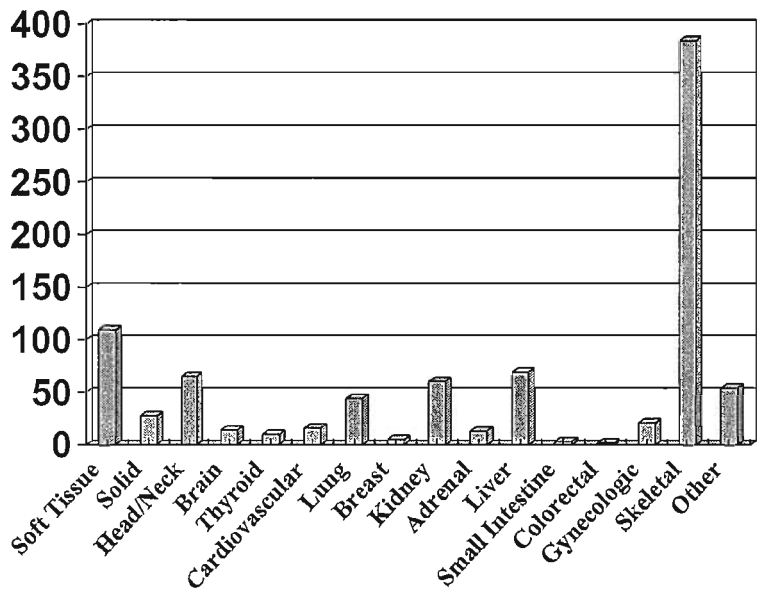

Fig. 4. Total number of incidental findings by system.

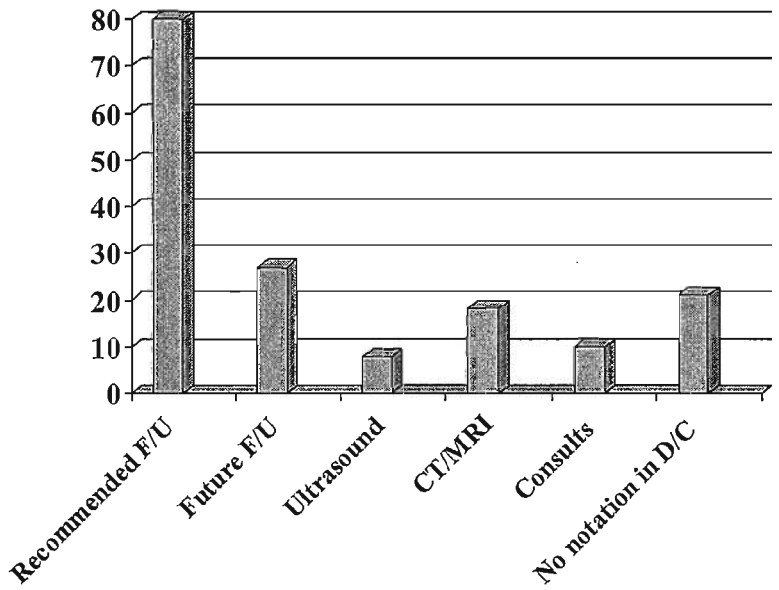

Fig. 5. Recommended follow-up per radiology reports vs. actual follow-up.

Table 2 Skeletal findings and follow-up data.

System		Number Incidental Findings	Recommended Follow-up	Recommended future follow-up	Actual follow-up
Skeletal	Degenerative disc disease	119			
	Degenerative changes	115			
	Spur/osteophyte	74			
	Spondylolisthesis	15			
	Schmorl's node	12			
	Solid lesion	10	3	1	1
	Osteopenia	9	1		
	Spondylolsis	6			
	Other	6			
	Pars defect	4			
	Spina bifida occulta	3			
	Herniated disc	3			
	Spinal stenosis	3			
	Compression	2			
	Cystic lesion	2			
	Atlantoaxial instability	1			1
	Total Number	384	4	1	2

Table 3 Hepatic findings and follow-up data.

System		Number Incidental Findings	Recommended Follow-up	Recommended future follow-up	Actual follow-up
Liver	Cyst	29	1		1
	Fatty liver	23			
	Lesion	11	7		5
	Hemangioma	5	1		
	Cirrhosis	1			
	Total Number	69	9	0	6

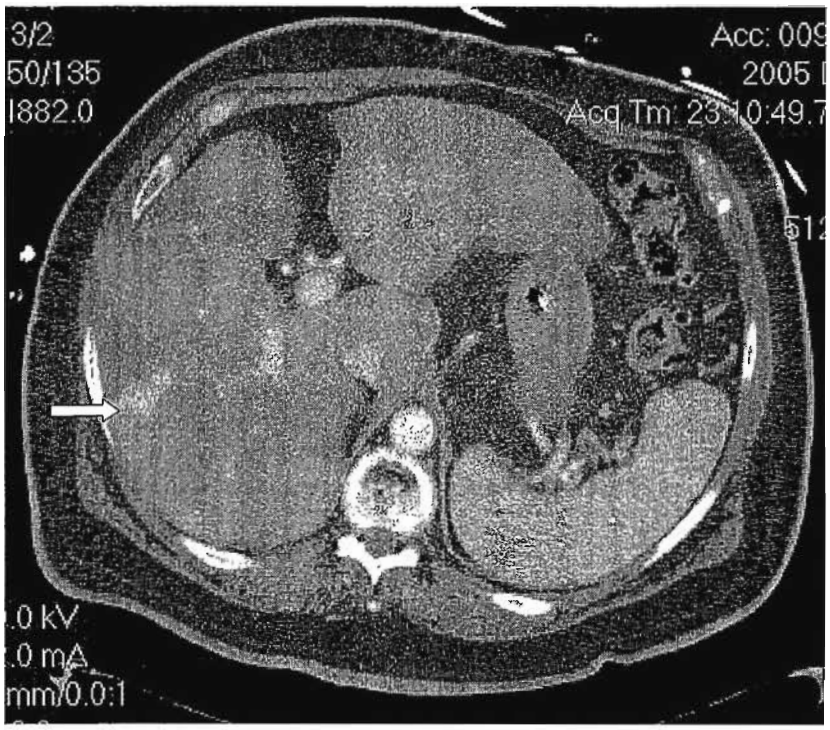

Fig. 6. *Patient with 2.5 cm hepatic mass.*

Table 4 Head and neck findings with follow-up data.

System		Number Incidental Findings	Recommended Follow-up	Recommended future follow-up	Actual follow-up
Head/Neck	Sinusitis	52			
	Tracheal lymph node	3			
	Polyp	3			
	Density left ear	1			
	Calcified density left of mandible	1			
	Dental abscess	1			
	Abscess neck	1			
	Mandibular lesion	1	1		
	Mass R nare	1	1		1
	Orbital lesion	1	1		
	Total Number	65	3	0	1

Table 5 Renal findings with follow-up data.

System		Number Incidental Findings	Recommended Follow-up	Recommended future follow-up	Actual follow-up
Kidney	Cyst	50		3	2
	Calculi	5			
	Atrophy	2			
	Lesion	2	1		
	Calcification	1			
	Total Number	60	1	3	2

Table 6 Other diagnoses with follow-up data.

System		Number Incidental Findings	Recommended Follow-up	Recommended future follow-up	Actual follow-up
Other	Gallstone	13			
	Hiatal hernia (includes paraesophageal hernia)	9	1		1
	Inguinal/umbilical hernia	7			
	Lymphadenopathy not otherwise specified	7			
	Enlarged prostate	7			1
	Splenic cyst	2			
	Gastric wall thickening	1	1		1
	Zenker's diverticulum	1			1
	Hemangioma spleen	1			
	Mediastinal mass	1	1		1
	Granuloma spleen	1			
	Diverticulosis	1			
	Pancreatic cyst	1			
	Diverticulosis	1			
	Cholecystitis	1			
	Total Number	54	3	0	5

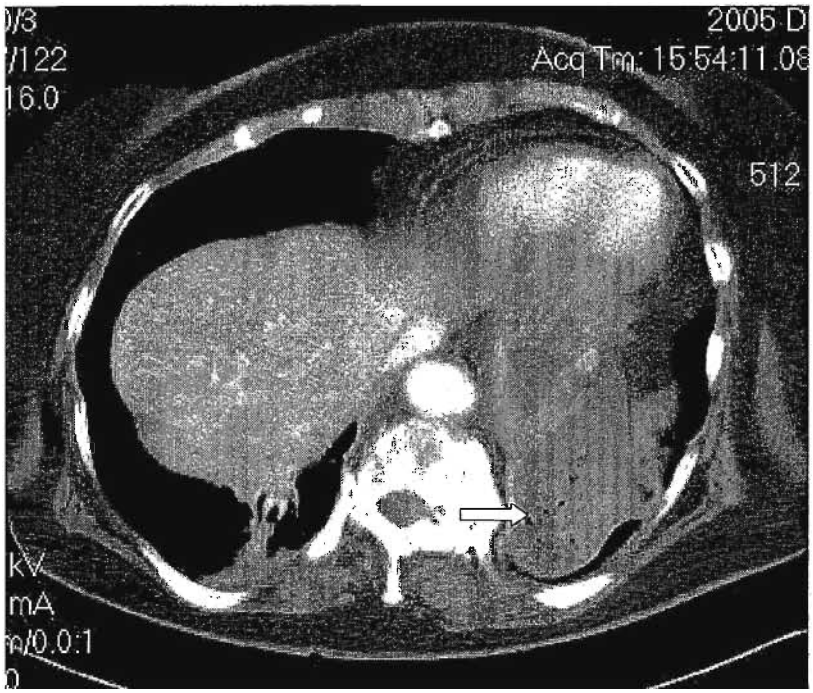

Fig. 7. *Seventy-three year-old female with left-sided paraesophageal hernia.*

Table 7 Pulmonary findings with follow-up data.

System		Number Incidental Findings	Recommended Follow-up	Recommended future follow-up	Actual follow-up
Lung	Nodule	24	4	13	3
	Bleb/emphysema	6			
	Lymph node	4			
	Lesion (not specified)	3	1	2	1
	Granuloma	2			
	Thickening (pleural, right major fissure)	2			
	Cyst	1			
	Biapical parenchymal scarring	1			
	Cystic lucency	1			
	Total Number	44	5	15	4

Table 8 Gynecologic findings with follow-up data.

System		Number Incidental Findings	Recommended Follow-up	Recommended future follow-up	Actual follow-up
Gynecologic	Adnexal cyst	14	1	1	
	Uterine lesion	4	1		1
	enlarged uterine	1	1		
	Fibroid	1			
	Left ovarian tumor	1	1		1
	Total Number	21	4	1	2

Table 9 Cardiovascular findings with follow-up data.

System		Number Incidental Findings	Recommended Follow-up	Recommended future follow-up	Actual follow-up
Cardiovascular	Calcified mitral annulus with left atrial enlargement	1			
	Other (atherosclerosis, ectasia, aortoiliac vascular calcification)	12	1		1
	Abdominal aortic aneurysm	2			
	Common iliac aneurysm (right)	1	1		1
	Total Number	16	2	0	2

Table 10 Intracranial findings with follow-up data.

System		Number Incidental Findings	Recommended Follow-up	Recommended future follow-up	Actual follow-up
Brain	Hydrocephalus	3	2		2
	Atrophy	2			
	Other cyst	2			
	Round density fornix (not specified)	1	1		1
	Lipoma	1			
	Chronic hygroma	1			1
	Arachnoid cyst	1			
	Cavum septum vergae	1	1		
	Calcification	1			
	Dolichoectasia	1			
	Total Number	14	4	0	4

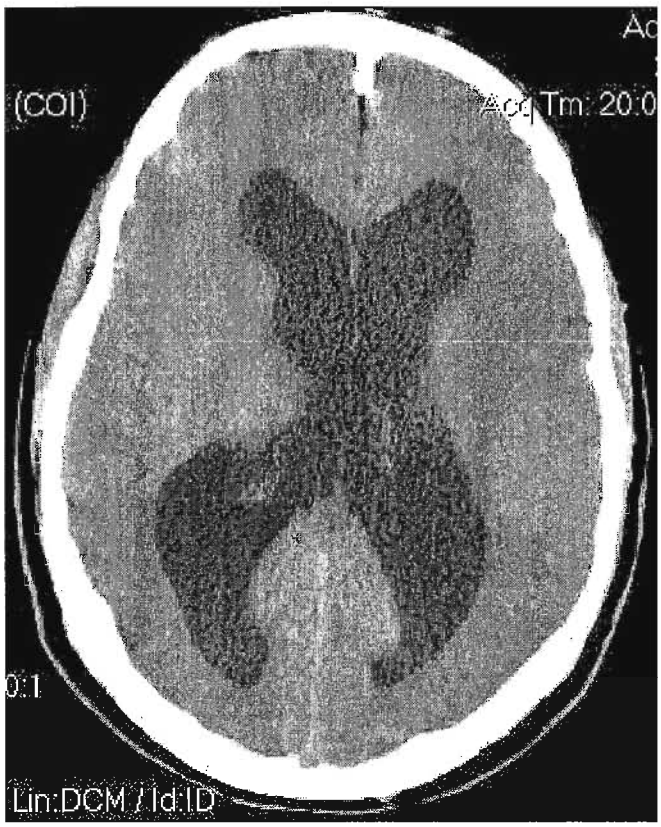

Fig 8. *Head CT of 47 year-old gentleman diagnosed with chronic hydrocephalus.*

Table 11 Adrenal findings with follow-up data.

System		Number Incidental Findings	Recommended Follow-up	Recommended future follow-up	Actual follow-up
Adrenal	Density (including adenoma)	9	6	2	3
	Enlarged	2	1		1
	Fullness	1		1	
	Nodule	1	1		1
	Total Number	13	8	3	5

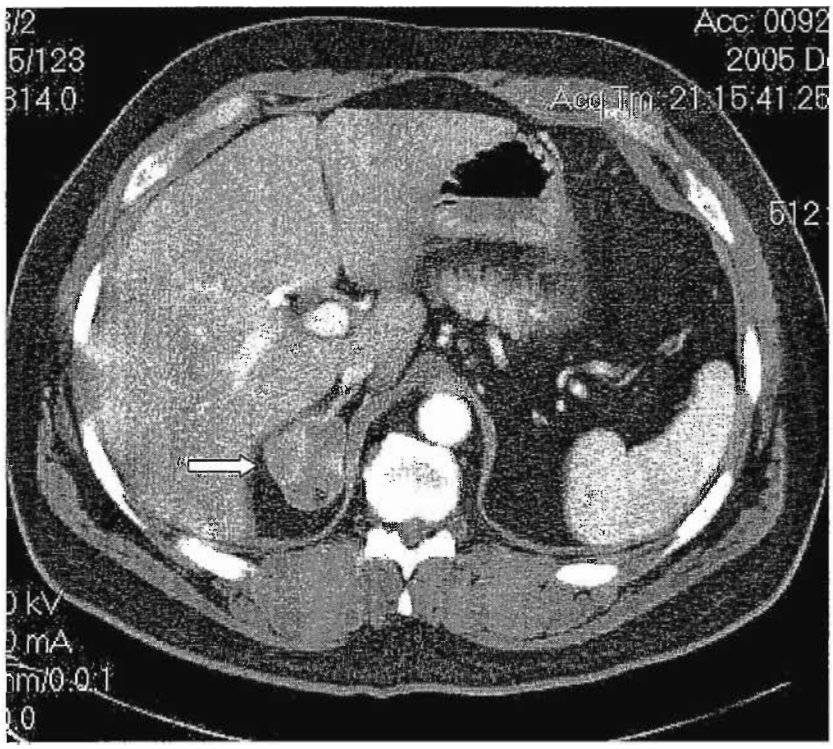

Fig. 9. *3.5 cm adrenal mass discovered in a 44 year-old male with history of colon cancer.*

Table 12 Thyroid findings with follow-up data.

System		Number Incidental Findings	Recommended Follow-up	Recommended future follow-up	Actual follow-up
Thyroid	Lesion	3	1	1	1
	Hypodensity	2		1	
	Enlargement	2	1		
	Calcification	2			1
	Cyst	1	1		
	Total Number	10	3	2	2

Table 13 Breast findings with follow-up data.

System		Number Incidental Findings	Recommended Follow-up	Recommended future follow-up	Actual follow-up
Breast	Mass	5	3	1	
	Total Number	5	3	1	0

Table 14 Colorectal findings with follow-up data.

System		Number Incidental Findings	Recommended Follow-up	Recommended future follow-up	Actual follow-up
Colorectal	Polyp	1	1		1
	Density Cecum	1	1		1
	Total Number	2	2	0	2

Table 15 Small intestine findings with follow-up data.

System		Number Incidental Findings	Recommended Follow-up	Recommended future follow-up	Actual follow-up
Small Intestine	Intussesception	1	1		1
	Thickening	1	1		1
	Lipoma	1			
	Total Number	3	2	0	2

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